

CB(1)1109/13-14(28)



For this Saturday's special meeting of the Legco Panel on Environmental Affairs  
(Saturday 22 March 2014) - written submission of Tom Hope

Tom Hope

to:

panel\_ea, mpoon, yspang

17/03/2014 16:16

Hide Details

From: "Tom Hope" < >

To: <panel\_ea@legco.gov.hk>, <mpoon@legco.gov.hk>, <yspang@legco.gov.hk>

## 2 Attachments



140317\_SKC\_Brochure\_A NECESSARY EVIL\_Legco Environment Panel\_submission.doc



140118- PG v I Leaflet v.2.pdf

For the special meeting this Saturday 22<sup>nd</sup> March to discuss the administration's proposals for landfill expansion plus SKC incinerator, the following builds on the submission made to the Panel prior to its consideration on 24 February of the administration's proposals for extension of existing landfill and construction of an incinerator at Shek Kwu Chau. It sets out compelling reasons for Legco representatives to deny or defer approval of those proposals:

1. To extend existing landfills is against the wishes of all local and district representative bodies for the New Territories.
2. It follows that it is also against their wishes to build the SKC incinerator, since this technology necessitates landfill extension (in which to dump its ash residues - which is why ENB/EPD continue to push for landfill expansion, even with the proposed SKC incinerator operating at 3,000 tpd).
3. Landfill expansion is not required if the alternative thermal treatment technology of gasification is adopted instead – see (a) attached report 'A Necessary Evil?', circulated to EAP members in April 2012, updated to reference additional gasification facilities elsewhere in the world operating to the requisite scale and (b) attached report of the New Territories Concern Group comparing gasification v incineration.
4. An especial advantage of gasification is that it leaves no residues needing to be landfilled.
5. The New Territories Concern Group also recommends immediate implementation of measures to separate out organic waste so that this no longer goes to landfill. Half of the waste currently going to landfill is organic waste. It is this organic waste which makes the landfills so unpleasant for those who live nearby because of the smell, insects, leaching etc.
6. The ENB/EPD paper states (para 9(k), page 6) that upon full commissioning of the Sludge Treatment Facility in Tuen Mun by end 2014 'odorous sludge will no longer be landfilled'. This is simply not so. The STF's stated capacity is 2,000 tpd but Hong Kong's daily output of odorous (ie organic) waste is over 4,000 tpd. Even if it had the necessary capacity, territory wide measures are not in place to

- separate out organic from other waste for processing by this STF; until they are, landfills will continue to absorb this odorous waste because it cannot be sent elsewhere. (This is tacitly accepted by ENB/EPD in their proposals for food and yard waste published at the end of last month which sets out an optimized objective – based on the construction of 4 OWTF centres - of 40% separation and treatment of food waste by 2022, with the remaining 60% organic waste to be incinerated or landfilled.)
7. A feasible territory-wide plan to separate organic from other waste has been put to Chief Secretary Carrie Lam and Secretary for the Environment K.S.Wong by NGO Clear The Air, as previously circulated to all EAP Legco members. This plan can eliminate odorous waste from and halve total waste now going to landfill. This plan can therefore double the projected lifespan of existing landfill. This plan is supported by the New Territories Concern Group and other similarly representative bodies. This plan can be operational within 1 year, diverting up to 100% of food waste from landfill at a fraction of the cost of ENB/EPD's proposals of last month.
  8. Doubling the life of existing landfill allows time for a pilot gasification plant operating at requisite scale (eg 400 tpd) to demonstrate its suitability for processing Hong Kong's residual waste. If initiated now, such a plant could be operational by 2016/7.
  9. The New Territories Concern Group, after canvassing the views of those living and working in the New Territories and after making a fact-finding mission to Europe in September 2013 to review gasification facilities, now recommends and guarantees local support for a gasification pilot plant adjacent to an existing landfill.
  10. The NTCG recommends this because (a) it immediately diverts waste from landfill (b) it is a cleaner and more cost-effective way to deal with residual waste (c) it is modular, allowing increased capacity to suit projected waste flows (d) even if it exceeds projected need, it can be used to backmine and so reclaim existing landfills for other uses (eg residential/commercial).
  11. EAP members who went on an equivalent fact-finding visit to Europe earlier this month are now all the better placed to confirm that contemporary gasification technology is feasible for immediate implementation to the requisite scale in Hong Kong.
  12. ENB/EPD proposals should in any event be rejected until real and immediate territory-wide steps are taken to implement their proposed RRR (reduce-recycle-reuse) strategy by:
    - a. Separation of organic waste
    - b. Waste charging
    - c. Improved recycling.
  13. For the same or lesser cost to that now proposed by ENB/EPD, these alternative strategies can, within a 3 to 4 year period ie by 2018 latest:
    - a. Double the life of existing landfill
    - b. Eliminate odour, flies etc from existing landfill
    - c. Divert non-organic waste from landfill to a pilot gasification plant
    - d. Incentivize a 'zero waste' approach for Hong Kong requiring NO further extension of landfill and (using gasification plants) reclamation of existing landfill for other use by backmining.

Thank you for your attention.

Tom Hope  
 (HK ID no. \_\_\_\_\_ – HK resident since 1988 – solicitor HK/England & Wales – supporter of New Territories Concern Group)

**A NECESSARY EVIL?**

**(WHY MASS-BURN INCINERATION IS EVIL BUT NOT NECESSARY  
FOR HONG KONG'S FUTURE MANAGEMENT OF WASTE)**

## **WHAT EXACTLY IS THE 'EVIL'?**

The HK administration says it is a 'necessary evil' to put a mass-burn incinerator on Shek Kwu Chau island.

We agree that this is an 'evil'. We don't agree that it is 'necessary'.

## **WHAT'S EVIL ABOUT IT?**

The HK administration's proposal is evil because:

- It will not solve the problem of landfill exhaustion
  - Up to one third of incinerated MSW comes back out as toxic ash which, after further treatment, goes into landfill
  - It cannot come into operation until 2021/2, 3 years after the last landfill is exhausted (on current government projections).
- It means the permanent destruction of coastline zoned for conservation and remarkable for its natural beauty.
- It will be very expensive to build and it will run at a significant loss, year-on-year.
- It will have a significant impact on HK's air quality.
- It wastes HK's Municipal Solid Waste (MSW) by treating it as a problem instead of a resource.
- It requires a constant supply of MSW (3,000 tonnes per day) to operate efficiently, and so will not encourage waste reduction.

**WHAT ARE THE EVIL ASSUMPTIONS WHICH MAKE THE ADMINISTRATIONS' INCINERATOR PROPOSAL SEEM 'NECESSARY'?**

- **Assumption 1:** *"MSW is a problem, not a resource."*
- **Assumption 2:** *"There's no time to waste in testing other options because we are running out of landfill."*
- **Assumption 3:** *"HK will have to live with a poorer environment until longer term solutions are found."*

**Each of these assumptions are 'evil' because they are each untrue and they each support the notion of the MBI incinerator as a 'necessary evil'.**

**But that evil is not necessary – and here's why ...**

## **WHY THE EVIL IS NOT NECESSARY**

- **With a more rigorous policy of Reduce-Recycle-Reuse, there can be much less MSW to dispose of.** The Administration admits this. When asked how it will cope between 2019 (when it expects to exhaust all landfill) and 2022 (when the SKC incinerator comes onstream), EPD says it will rely on more stringent waste management to prolong landfill life. That's tantamount to admitting it could have done much more much sooner to reduce levels of MSW in Hong Kong.
- **By using a different technology in a different location, the residual MSW can be transformed into useful energy:**
  - with no toxic outputs
  - at a quarter (or less) of the cost
  - no later than 2017 if approved now
  - with no permanent damage to any part of Hong Kong
  - with no deterioration of air quality
  - operating at a profit year-on-year

## **WHAT IS THE DIFFERENT ('NON-EVIL') TECHNOLOGY?**

There are many alternative technologies to MBI in terms of non-polluting and environmentally preferable effects.

However, there is one kind of technology which is especially preferable to meet HK's current MSW needs. This technology (of which there are variants but all use essentially the same methodology) is referred to for convenience as Plasma Gasification (or Plasma Gas for short).

Plasma Gas is preferable to MBI because it has all the benefits listed above and:

- because it has no toxic emissions, it can be located anywhere
- it can be installed on a modular basis, with standard units operating in series
- it can be built up incrementally using a smaller land footprint.
- because it is more efficient in converting waste to energy, it can operate at a profit
- because it can be located next to landfill, that landfill can be mined and so reduced – and transformed into profitable energy.

So, as and when more rigorous waste management policies make it unnecessary to build more Plasma Gas capacity, existing Plasma Gas facilities can continue to operate profitably transforming MSW from – and so gradually eliminating – existing landfill.

**In other words, Plasma Gas:**

- **is not a 'necessary evil'; but**
- **is an 'incremental benefit', a non-toxic cost-effective safety net for dealing with excess MSW: a 'win win' for Hong Kong, using appropriate technology to maximum environmental and business advantage.**



## **WHAT IS PLASMA GAS TECHNOLOGY?**

To understand Plasma Gas, it helps to understand how it's different from MBI.

MBI is a combustion process which uses an excess of oxygen and/or air to burn the MSW. The mass burn process operates with an excess of oxygen present and is therefore a combustion process.

Plasma Gas, by contrast, depends on having no oxygen. It does not burn the MSW. Instead it turns 99% of the MSW into gas, using plasma arc torches to create very high temperatures (typically 4000°C - 7000°C). This 'syngas' can then be converted into energy.

The remaining 1% of the MSW produces a rock-like by-product called vitrified slag. This byproduct is safe and can be resold as building material. It need not go to landfill.

## **IS PLASMA GAS AN ESTABLISHED TECHNOLOGY?**

Yes. The Plasma Gasification technology has been industrially applied worldwide for 30+ years.

HK's administration says it has considered and discounted this technology on the advice of Aecom HK, the external consultants hired by EPD to handle the technical and environmental aspects of implementing the SKC incinerator project.

Aecom is an international consultancy. Here's what its US division says about Plasma Gas:

***"We believe that this technology is not only environmentally friendly, but ready for large-scale commercialisation."*** (Mike Zebell of Aecom US, commenting on Milwaukee's plans to proceed with a 1,200 tonne per day plant using plasma gas technology.)

## **WHERE ELSE IS PLASMA GAS USED FOR TREATING MSW?**

The application of Plasma Gas to MSW is relatively recent, within the last 30 years.

Most of the Plasma Gas facilities for MSW now in operation deal with relatively small volumes of waste.

Their success in treating MSW means that many more such facilities are being built or have been approved by municipal/environmental authorities for construction.

The table below gives details of MSW facilities now operating, under construction or approved.

<b>Location</b>	<b>Consortium</b>	<b>Capacity (tonnes per day)</b>	<b>Operating from</b>	<b>Build status</b>	<b>Comments</b>
Ohio, USA	General Motors	2400	1987	Built	Feedstock is scrap metal (harder to process than MSW).  98% operating efficiency
Mihama Mikata	Hitachi Metals	22	2002	Built	Operating without problems for foreseeable future.
Utashinai, Japan	Hitachi Metals	220	2003 to 2013	Built	EPD say it operated poorly which is why it had to close in 2013. In fact, operational issues were resolved. It closed for lack of feedstock which meant it could not operate at a profit.
Tainan,	PEAT	35	2004	Built	Operating

Taiwan	International				without incident
Toronto, Canada	Plasco	100, but approved to upgrade to 300	2008	Upscale in progress, pending financing	Approved for 24/7 commercial operation by Toronto City Council in November 2011
Vero Beach, USA	INEOS Bio	275	2012	Built	Attains full capacity in 2014
Wuhan, China	Wuhan Kaidi/ Alter NRG	100	2013	Built	Alter NRG (Westinghouse Plasma) are supplying the furnaces
Morcenx, France	Europlasma	140	2014	Built	Currently commissioning
Teeside, UK	AirProducts	950	2014	Built	Starts to operate April-May 2014
Teeside, UK	AirProducts	950	2016	In progress	A mirror image of the 2014 Teeside project - Alter NRG (Westinghouse Plasma) are supplying the furnaces
Oldbury, UK	Chinook Sciences / EMR	950	2014	In progress	Uses award winning Active Pyrolysis technology developed by Chinook
Edmonton, Canada	Enerkem/ AIEES	275	2014	In progress	Increases landfill diversion of Edmonton's MSW from

					60% (through RRR) to 90%
Milwaukee, USA	Alliance Federated Energy	500	2014	In progress	Aecom US project consultants. Design and build by CorVal-Ryan.
Connecticut, USA	SAIC	800	2014	In progress	
London City Airport	Solena	1400	2015	In progress	Will produce jet fuel – see further Solena submission to EPD re IWMF EIA
Glasgow, UK	Viridor	550	2016	In progress	
Belfast, UK	Bombardier Aerospace/	330	2016	In progress	
Bijie, China	BGE	600	2016	Awaiting final approvals	Alter NRG (Westinghouse Plasma) are supplying the furnaces. Mirror image gasifier planned to double capacity.

## **WHO ARE THE ESTABLISHED PROVIDERS OF PLASMA GAS?**

From the above table it can be seen that, worldwide, there are multiple commercial enterprises with experience of implementing Plasma Gas facilities for MSW. To prepare this document, we have talked to the following groups:

Advanced Plasma Products/Tetronics  
Air Products  
Alter NRG (Westinghouse Plasma)  
Phoenix Technologies  
Plasco  
SolenaTechnip

None of these are listed in the EIA for Hong Kong's IWMF.

**The EPD claims that in evaluating the potential of Plasma Gas for this project, AECOM contacted the most significant suppliers. None of those we talked to knew of any such contact.**

**AECOM has now visited the UK headquarters of APP/Tetronics. Based on this visit, it invited submission of a proposal from APP to introduce plasma gas to HK for MSW treatment.**

**However, EPD insists that Plasma Gas will not be considered for its IWMF Phase 1 (the 'necessary evil' proposed for Shek Kwu Chau).**

**Further, APP has received no substantive response to its proposal since submission to EPD/AECOM in February 2012, as re-submitted to Legco's Environment Panel for its meeting in March 2012 – a facility for which it was prepared to underwrite the entire build cost.**

**APP has repeatedly stated its willingness to come to Hong Kong to discuss the proposal with appropriate decision makers.**

## **IS PLASMA GAS THE BEST SOLUTION FOR SHEK KWU CHAU?**

The simple answer is – ‘NO’.

It’s clear that Plasma Gas is far preferable to MBI in any location.

It’s also clear that the proposed reclamation for Shek Kwu Chau could house a Plasma Gas facility for the same or lower cost and with no downsides – and many incremental benefits.

However, to substitute Plasma Gas for MBI on Shek Kwu Chau would be foolish to the point of being itself an ‘evil’.

The reasons why it would be such an (unnecessary) evil include:

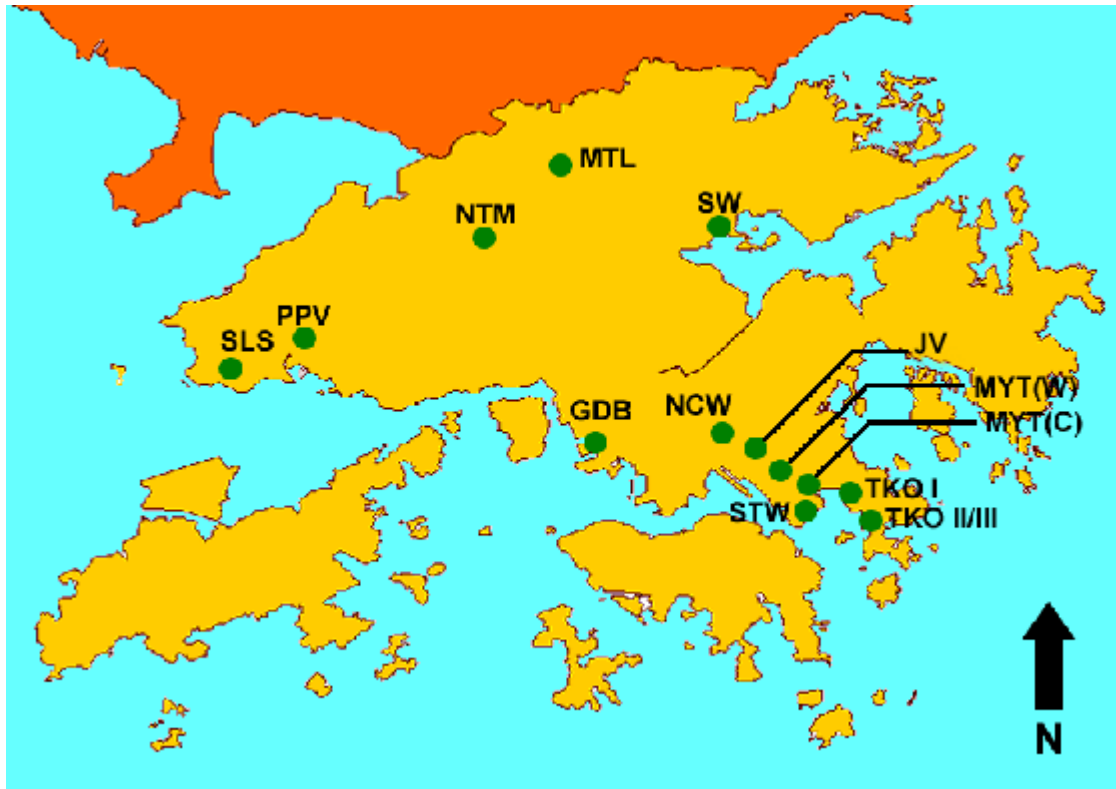
- permanent despoiling of a particularly beautiful stretch of HK’s coast
- exorbitant cost
- delayed operation of the facility beyond 2017

-

## **SO WHAT'S THE BEST WAY TO USE PLASMA GAS IN HONG KONG?**

Because Plasma Gas facilities are safe to locate near urban environments and can be used to mine landfill, the best way to use Plasma Gas facilities in Hong Kong is to locate them next to existing or exhausted landfill sites.

There are 13 of these exhausted sites in Hong Kong.



By locating Plasma Gas facilities in this way, they can be wholly and holistically integrated in HK's overall waste management strategy and so merit the moniker 'IWMF'.



## **HOW LARGE OR SMALL SHOULD THE FIRST PLASMA GAS IWMF BE?**

For the same cost as building the proposed MBI mega-incinerator on Shek Kwu Chau, Hong Kong could have THREE plasma arc facilities of equivalent capacity (ie. handling in total THREE times the volume of waste as the proposed incinerator).

However, such a mega-spend is not necessary.

A more sensible strategic approach is to build an initial smaller scale Plasma Gas facility at one or more of the existing landfill sites. In this way:

- the Administration will remain incentivized to bring in more rigorous waste management policies, which everyone agrees are necessary to make Hong Kong more responsible for managing its own waste.
- use can be maximized of existing infrastructure (eg transportation of waste) for feeding the Plasma Gas facility with MSW
- arrangements for pre-sorting and shredding of MSW can be tested and optimized before rolling out more broadly if required.
- should more rigorous waste management policies make it unnecessary to build more Plasma Gas capacity, the existing Plasma Gas facilities can continue to operate profitably, transforming MSW from – and so gradually eliminating – existing landfill.

Because Plasma Gas facilities can be built incrementally, the initial test plant can be as small as 100tpd per location.

However, economies of scale make it preferable to plan for initial capacity of around 1,000 tpd per location.

## **WHAT WILL A PLASMA GAS FACILITY LOOK LIKE?**

In terms of likely visual impact, plasma gas facilities:

- generally use a basic box shape for each modular unit
- have low chimney stacks (max 30 metres high)
- can be situated on land or sea with no significant safety risks in the event of earthquake, tsunami or other act of god.
- can be sculpted to suit a low contoured landscape
- can be easily dismantled

**- WHAT ARE THE PERCEIVED RISKS OF USING PLASMA GAS?**

The table below sets out a critique of Plasma Gas in relation to perceived potential risks or defects, with comparable criticisms made of MBI :

<b>Perceived risk or defect</b>	<b>Plasma – how to compensate</b>	<b>MBI – perceived risk or defect</b>	<b>MBI – how to compensate</b>	<b>Comments</b>
Can only deal in small volumes of MSW	Upscale with modular units in series	Can only deal in large volumes of MSW	Ensure consistent high volume throughput of MSW	
1998 German pyrolysis plant explosion leading to closure	100% safety record for plasma gasification (as distinct from pyrolysis)	In last 5 years, closure of plants in UK (unsafe emissions), US (too expensive) and Taiwan + Singapore (reduced MSW levels)	Safety: Improve filters + scrubbers  Cost: Increase tipping fees  Reduced feedstock: import waste from outside HK	Enhanced filters increases toxicity of output ash.  Increased tipping fees politically unacceptable.  Import waste not acceptable if done at cost with attendant health risks.
Requires pre-sorting and shredding of waste	Shredding to get consistent feedstock – sorting beneficial but not essential because plasma gasification copes with all kinds of MSW	Requires pre-sorting and shredding of waste	Pre-sorting essential to remove more toxic items and minimize stoppage (dioxin emissions highest when stopping or starting)	
Few proven suppliers worldwide	Work with established contractors backed by contractual guarantees	Few suppliers able to operate on mega-scale	Work with established contractors backed by contractual guarantees	

### **SO WHICH WILL YOU CHOOSE: THE NECESSARY EVIL OF MBI ...**

- Maximum cost for minimum returns from MSW resource
- Permanently despoiling pristine coastline / Conservation Area
- Polluting the environment
- Adding to HK's carbon footprint
- No long term solution to landfill exhaustion

### **... OR THE INCREMENTAL BENEFIT OF PLASMA GAS?**

- Maximum return for less overall cost from MSW resource
- Reclaiming landfill sites with no short or long term damage to HK's environment
- No toxic outputs
- Reducing HK's carbon footprint
- Up-scalable in flexible response to HK's waste management needs
- A 'win win' solution in every way!

17 March 2014

## 等離子氣化 vs 焚化 Plasma Gasification vs Incineration

等離子氣化技術 Plasma Gasification	焚化技術 Incineration
72億港元成本 Total cost: HK\$7.2 billion	420億港元成本 Total cost: HK\$42 billion
2,000公噸 固體廢物垃圾處理量 (每日) 2,000 MSW processed (tpd)	3,000至4,000公噸 固體廢物垃圾處理量 (每日) 3,000 to 4,000 MSW processed (tpd)
支援回壘堆填區土地 Supports reverse mining	不支援回壘堆填區土地， 因為灰會被置於堆填區 Does not support reverse land mining, as the ash requires to be dumped into landfills
副產品：泥渣，15%的垃圾將會成為惰成泥渣， 可以成為安全的建築混合物，減少入口 Slag as by-product with as much as 15% of waste becomes inert slag which can be safely used and reduces the need to import aggregate	副產品：飛灰和底灰，原本垃圾的 30%體積需要堆填區 Fly Ash and Bottom Ash as by-product with as much as 30% requiring careful disposal
1,200°C至10,000+°C之間運作 Operates between 1,200°C and 10,000+°C	700°C至1000°C之間運作 Operates between 700°C and 1,000°C
從電力輸入啟動，但在產生足夠電力後， 能自給自足 Requires initial input of electricity but becomes self-sufficient when the plant produces electricity itself	需要碳氫燃料或氣體燃料啟動燃燒 Requires hydrocarbon fuel or fuel gas to start burning of waste
幾乎不需要氧氣，因此沒有燃燒 Little to no oxygen is required, therefore no combustion	需要氧氣以燃燒 Air is required for complete combustion
低排放 Lower emissions	溫室氣體、污染物及有毒的灰排放量 大 Greater emissions of greenhouse gases, pollutants and toxic ash

如你想表達你的支持，歡迎登上我們的網址[www.ntconcerngp.com](http://www.ntconcerngp.com)，一起聯署要求政府考慮更先進的垃圾處理技術。如想得到更多資料，歡迎聯絡我們：

If you want to show your support, please sign up at [www.ntconcerngp.com](http://www.ntconcerngp.com) where we will ask for government's consideration for a more advanced MSW management technology. You can get more information from:

電話 Telephone: 9820 3803

電郵 Email: [nt01group@gmail.com](mailto:nt01group@gmail.com)

地址 Address:

Facebook: [www.facebook.com/ntconcerngp](http://www.facebook.com/ntconcerngp)

屯門良田村77號2樓

網址website: [www.ntconcerngp.com](http://www.ntconcerngp.com)

2/F No.77, Leung Tin Village, Tuen Mun



我們亦會於下列日子舉行地區諮詢會，歡迎你的參與支援回壘堆填區土地支援回壘堆填區土地：

We welcome your participation to these districts discussions:

2014-1-8	屯門新墟仁愛廣場 Yan Oi Tong Square, San Hui, Tuen Mun
2014-1-18	將軍澳港鐵站A2出口唐俊街及寶邑街交界 Tseung Kwan O MTR exit A2 on the corner of Tong Chun Street and Po Yap Road
2014-1-25	上水符興街石湖墟遊樂場 Shek Wu Hui Playground, Fu Hing Street, Sheung Shui 稍後公布 TBC 全港討論會 Hong Kong territory wide forum and debate

確實地點和時間將於我們的網頁及facebook上公佈，敬請密切留意。  
Exact locations will be announced on our website and facebook.



## 新界關注大聯盟



- 反對擴建堆填區 Oppose the expansion of landfills!
- 反對興建焚化爐 Oppose the construction of incinerators!
- 支持採用新科技 Support the use of new technology!
- 等離子氣化「平、靚、正」  
Plasma Gasification is a CHEAPER, CLEANER and CLEVER solution

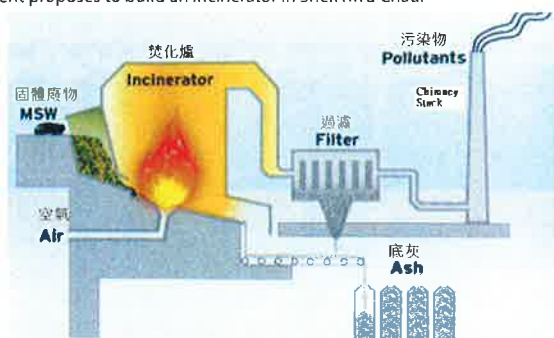
## 等離子氣化vs焚化爐 PLASMA GASIFICATION vs INCINERATION

### 政府說 The government says :

- 除非我們能找到一个適合可行的辦法，香港將會面對「垃圾圍城」的問題  
Unless we find a suitable solution, Hong Kong will become a territory surrounded by rubbish
- 儘管有減少、重用及回收的(3Rs)政策，政府指香港仍需要焚化爐技術及擴展堆填區  
Concurrently with the Reduce, Reuse and Recycle ("3Rs") policy, incineration technology and landfills are still required.

政府建議在石鼓洲起焚化爐：

The government proposes to build an incinerator in Shek Kwu Chau:



- 焚化屬於熱能技術，使用850°C的溫度在有氧情況下將垃圾完全燃燒  
It is thermal technology which burns rubbish at 850°C in the presence of oxygen for complete combustion
- 焚化爐需要一條高150米的煙肉來過濾及捕捉污染及懸浮物，如二氧化碳、呔喃及二噁英等  
It requires a 150 meter chimney stack to filter and catch pollutants and impurities such as CO<sub>2</sub>, furans and dioxins

### 焚化爐是否唯一選擇？ Is incineration our only choice?

- 絕不！ Noooooooooooooo!
- In fact, there is a better alternative i.e. Plasma Gasification ("PG")  
事實上，等離子氣化是一個更佳選擇

### 甚麼是等離子氣化？ What is Plasma Gasification?

- 等離子平時可見於自然閃電，而電荷穿過氣體時便會產生等離子，而等離子炬(Plasma torches)可以將等離子轉化成超過5,000°C的高溫，成為等離子氣化技術的能源。  
Plasma (naturally seen in lightning's flash) is produced when an electrical charge travels through gas and the plasma torch/arc generates this into heat capable of reaching temperature in excess of 5,000°C
- 極高熱力將垃圾分解至最基本的物質元素，如氫及一氧化碳等。  
The heat breaks down rubbish to its simplest elements such as Hydrogen and Carbon Monoxide
- 過濾過程可以產生可作建築物料之用的泥渣及有用的合成氣。  
A filtration process results in a byproduct such as slag and also produces a useful Syngas

### 1. 分解組件 2. 氣化過程 3. 合成氣潔淨 4. 能源潔淨



### 等離子氣化技術有多好？ How good is it?

- 等離子氣化是一個對三方面有利(共贏)的平、靚、正技術 It is a three-fold winning ("3Ws") solution

#### 1. 具成本效益 Cost-effective

- 等離子氣化技術(每日處理2,000噸垃圾)只要72億元(約100億元可興建處理3,000噸垃圾)  
PG technology (processing 2,000 tonnes per day "tpd") \$7.2 billion (about \$10 billion to build facilities processing 3,000 tpd)
- 焚化爐(處理每日3,000噸)需要420億  
Incineration (processing 3,000 tpd) \$42 billion

#### 2. 更有效及潔淨 More efficient and cleaner

- 更高的轉廢為能效率，而產出的合成氣可以轉化為：  
Greater EfW rates due to Syngas produced which can be converted into-
  - 電力 Electricity
  - 噴射燃料 Jet fuels
  - 合成氣 Synthetic Natural Gas
  - 熱能及蒸氣 Heat & Steam
- 副產品泥渣可以作建築物料之用  
Produces byproduct slag which can be reused as construction aggregate
- 不會排放二噁英、灰燼及二氧化碳  
No dioxins, ash or carbon dioxide discharged

#### 3. 社區、環境及政府都能受惠

##### The community, environment and government also benefit

- 4個社區及其環境都可以避免受到焚化破壞，甚至本身的堆填區可透過等離子氣化技術受惠  
4 communities and their environment affected by incineration and have landfills benefit from plasma gasification
 

● 石鼓洲 - 不需填海	Shek Kwu Chau - no reclamation
● 屯門 - 不需擴展堆填區	Tuen Mun - no landfill expansion
● 打鼓嶺 - 不需擴展堆填區	Ta Kwu Ling - no landfill expansion
● 將軍澳 - 擴展堆填區	Tseung Kwan O - no landfill expansion
- 屯門、打鼓嶺及將軍澳的堆填區亦可回復。  
Tuen Mun, Ta Kwu Ling and Tseung Kwan O's landfills can be backminded